a) A spring with k = 200. N/m is compressed 10.0 cm between the carts. What is the energy stored in the spring? What is the velocity of the two carts after the explosion? (note the sum of the kinetic energy = elastic energy)
(2kg and 1kg carts)

$$E_{elas} = \frac{1}{2} k \cdot x^2 = \frac{1}{2} \times 200 \times 0.100^2 = 1.00\,J$$

$$1.00\,J = \frac{1}{2} m_1 v_1^2 + \frac{1}{2} m_2 v_2^2$$

$$\Sigma p_i = \Sigma p_f$$

$$0 = m_1 v_1 + m_2 v_2$$

$$0 = x + 2y \qquad x = -2y$$

$$2 = x^2 + 2y^2$$

$$2 = 4y^2 + 2y^2$$

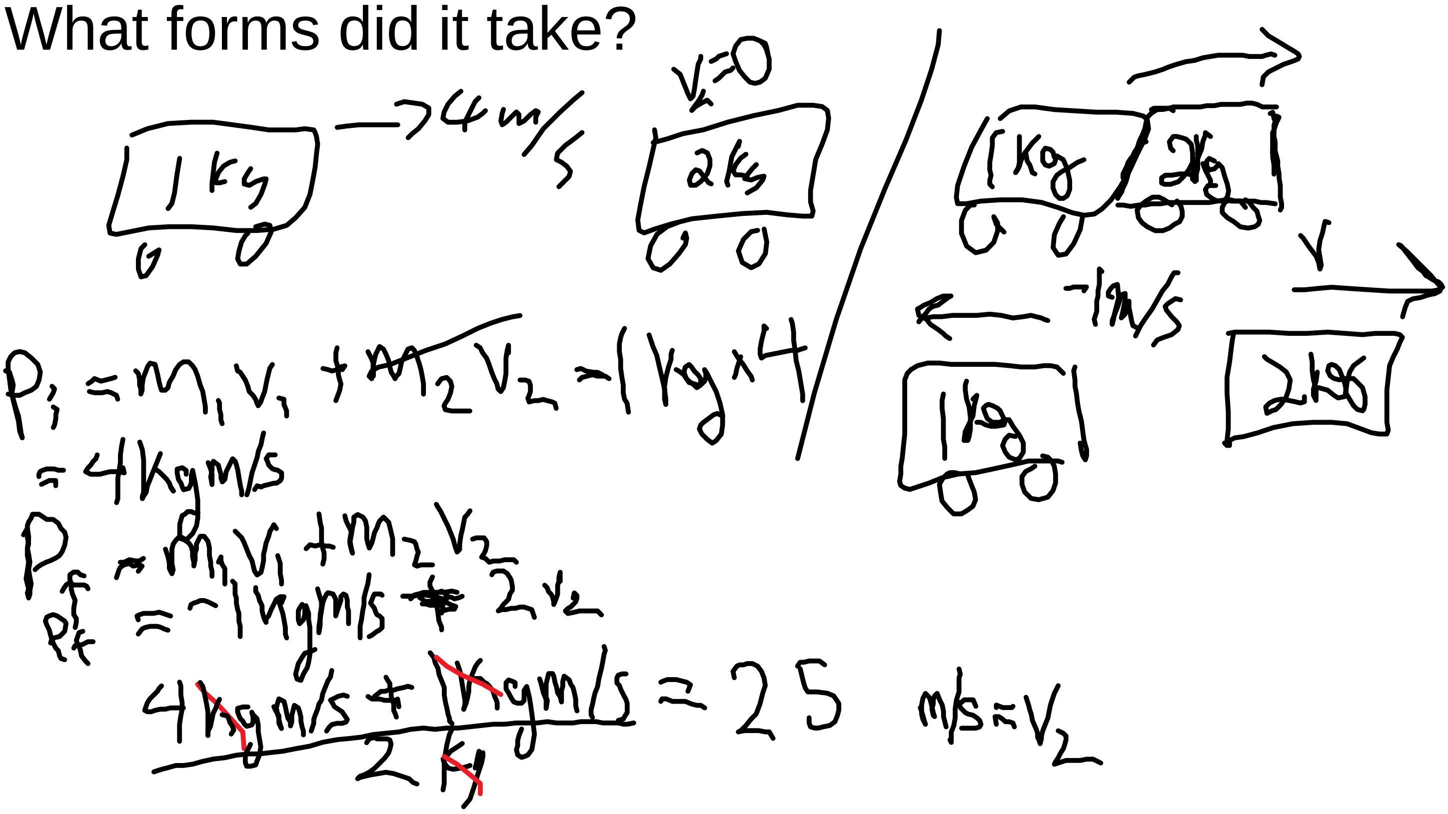
$$y = \pm\sqrt{\frac{2}{6}} = 0.57735\,m/s$$

x=-2y = -(2)x0.57735=-1.1547 ms/

x=-2y = -(2)x0.57735=-1.1547 m/s

the 1.0kg cart moves off at -1.15m/s while the 2.0kg cart moves off at 0.577 m/s.

b) the 1.0 kg cart is moving at 4.0 m/s when it hits the 2.0 kg cart at rest. If the 1.0 kg cart bounces back at -1.0 m/s, what is the velocity of the 2.0kg cart? How much kinetic energy was lost in the collision? What forms did it take?



$E_{totali} = E_{totalf}$

$1/2mv^2 = 1/2mv_1^2 + 1/2mv_2^2 + E_{lost}$

$1/2(1kg)(4m/s)^2 = 1/2(1kg)(-1m/s)^2 + 1/2(2kg)(2.5m/s)^2 + E_{lost}$

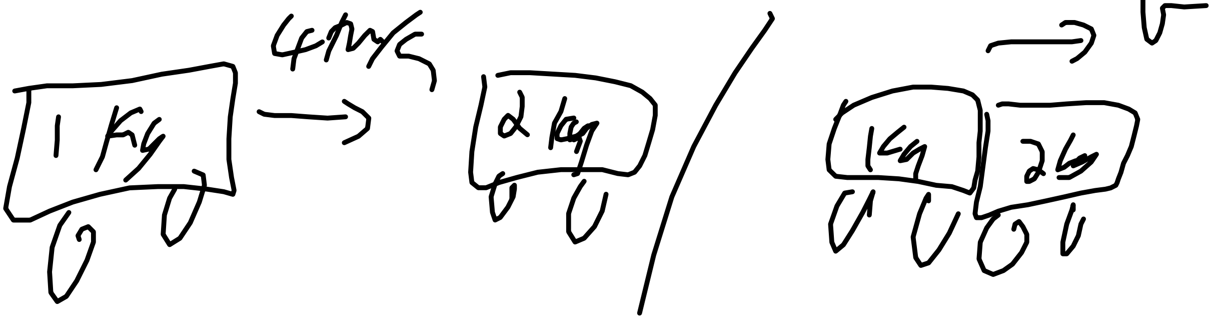
$E_{lost} = (8-(0.5+(2.5x2.5)))=1.25$ J energy is lost

Heat and sound (kinetic energy of the molecules of

the carts and air - IB term internal energy = sum of kinetic and potential energies of the molecules - Heat is the transfer of internal energy)

c) repeat c if the collision is perfectly elastic(no energy is lost , total kinetic energy is conserved)   what are the velocities of the two carts after the collision?

d) repeat c if the collision is perfectly inelastic (they stick together and move off together).



$4\,kg\,m/s = 3\,kg\,v$

$v = 1.3\,m/s$

$E_{ki} = 8\,J \qquad E_{kf} = \frac{1}{2}(3)(1.3)^2$

$E_{lost} = 5.3\,J$

$F_{lost} = $ [illegible]

d)

$$\Sigma P_i = \Sigma P_f \ *$$

*Perfectly elastic $\Sigma E_{k_i} = \Sigma E_{k_f}$

P: $4 = x + 2y$ $\quad x = (4 - 2y)$

E_k: $8 = \frac{1}{2}x^2 + y^2$

$$16 = (4-2y)^2 + 2y^2$$

$$16 = 16 - 16y + 4y^2 + 2y^2$$

$$0 = -16y + 6y^2$$

$$0 = -16 + 6y$$

$$y = \frac{16}{6}\ \text{m/s} = 2.67\ \text{m/s}$$

$y = \frac{16}{6}\,m/s = 2.67\,m/s$

$4 = x + 2y$

$4 = x + 2(2.67\,m/s)$

$x = -1.3\,m/s$

$ax^2+bx+c=0 \quad x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$

Hecht p237-238 q 47,49,53,55,57,59,60

competition:

pull down a spring and fire it as close to the ceiling as possible without hitting

a) work out equations to calculate the distance to pull it down
b) measure values you will need to do it.
c) fire it, one try only

paragraph - physics of driving in the snow